

these topics merit further development and attention to a fuller range of historiography. Moreover, problematic relationships between the rhetoric of *Kultur* and its institutional contexts sometimes remain unexplored. For example, Sonnert quotes a 1930 address by the theologian Adolf von Harnack expounding the characteristics of humanistic *Bildung* (p. 136) but leaves for the footnote the telling fact that Harnack was speaking in his role as president of the Kaiser-Wilhelm-Gesellschaft, arguably then the world's most successful institutionalization of integrated governmental and private funding of scientific research. But limitations of some kind are compelled by the scope of the book, and Sonnert successfully illuminates both consensus and debates within the discourse of *Kultur* up to the early 1900s.

The payoff lies in Chapters 6–9, which show how Einstein's family background, education, and approach to science relate to this prior history. In short, he was strongly indebted to a classical liberal tradition within the history of *Kultur*, which took the attainment of a rational, unified *Weltbild* as its supreme goal—in contrast or indeed in opposition to irrationalist, relativist variants. For Sonnert, a deep commitment to the notion of universal laws and symmetries underlying diverse physical phenomena was the common theme in practically all of Einstein's scientific work and, indeed, something akin to a religious conviction. This commitment in turn arose (in some fashion) out of the specifics of Einstein's schooling, reading, family history, and so forth. Sonnert relies here on Gerald Holton's concept of "themata" as formative in the development of scientific theories. Sonnert's account also demonstrates that, for all of Einstein's free-spiritedness, these commitments to unification and symmetry were tied to a cultural tradition with a rich and complex history. This should not come as a surprise to historians of science, but *Einstein and Culture* may inspire those who are new to the mysteries of German cultural history to explore these cultural ties further.

RICHARD H. BEYLER

Friedrich Steinle. *Explorative Experimente: Ampère, Faraday und die Ursprünge der Elektrodynamik.* (Wissenschaftsgeschichte: Boethius, 50.) 450 pp., apps., tables, bibl., index. Stuttgart: Franz Steiner Verlag, 2005. €80 (cloth).

From more than one point of view, last century was the century of theoretical physics. A number of increasingly abstract theories—which were also increasingly general and fundamental—

marked the physical sciences, from quantum mechanics and relativity to string theory, through QED, QCD, supersymmetry, and so on. No wonder, then, that in light of these astonishing developments, the efforts of historians and philosophers of science have been particularly focused on understanding the logical and conceptual relations between the theories, often confining experiments to the role of "handmaid" to the great creations of thought. But, fortunately, this situation started to change in the 1980s and 1990s, when new views of the philosophical and scientific status of experiments made their appearance.

Ian Hacking, Andrew Pickering, and Peter Galison, to mention only a few, claimed the autonomy of experiment and argued for its active role in framing theories, not only in testing them. Friedrich Steinle's book can surely be included in this promising line of work, often called "New Experimentalism." That this is the case becomes apparent when comparing Steinle's book with other major contributions on the same topic, the birth of modern electrodynamics. For example, in neither John Heilbron's *Electricity in the Seventeenth and Eighteenth Centuries* (California, 1979) nor Olivier Darrigol's *Electrodynamics from Ampère to Einstein* (Oxford, 2000)—two excellent studies on the subject—are the experimental aspects so systematically analyzed as in *Explorative Experimente*.

Before examining Steinle's main claims, let us look at the structure of the book. Steinle's work is divided into seven chapters. The first two deal with the general experimental culture in the study of electricity in the early nineteenth century and with Hans Christian Oersted's fundamental empirical discovery: the mutual action between electric and magnetic force. Steinle is very careful in stressing that the immediate impact of Oersted's results on the scientific community of Europe was due to the fact that they were obtained with widely accepted experimental procedures.

The third and fourth chapters are completely dedicated to an analysis of Andre Marie Ampère's contribution in the years 1820 and 1821. This is probably the most relevant and interesting section from a historical standpoint. The historical interest arises from the fact that Steinle has made use of many unpublished original documents and sources. These sources have been transcribed at the end of the book and are supplemented with some philological notes. Thus, Steinle is successful in presenting a fascinating picture of Ampère's style in experimental praxis and in contextualizing his research program

within the highly mathematized tradition of Laplacian physics.

The fifth and sixth chapters focus on Michael Faraday's work, pointing out in particular his different and more qualitative approach to experimental problems. This part of the work is also a meaningful extension of traditional analyses of the issue, because Steinle discusses a part of Faraday's work that has received scant attention—his work after the discovery of electromagnetic rotation.

Finally, in the seventh chapter some philosophical and sociological remarks are presented. Between the extremes of being theory laden and naively neutral, the concept of "explorative experiment" (pp. 313–316) emerges. There are particular periods in the history of science—what Steinle calls "formative periods" (pp. 19–21)—in which scientists have to build new conceptual frameworks to deal with new sets of empirical phenomena. In these periods the experiments are *explorative*: they are not completely neutral with respect to nature, but neither do they depend on a formal theory (which usually does not yet exist). These explorative experiments are not meant to test anything in particular but, rather, to guide the scientist in finding a conceptual way out of the difficulties. This explains the title of the book, which can be considered an interesting tool for a historically, philosophically, or sociologically oriented readership.

MASSIMILIANO BADINO

Peter Thorsheim. *Inventing Pollution: Coal, Smoke, and Culture in Britain since 1800.* (Series in Ecology and History.) xii + 307 pp., figs., bibl., index. Athens: Ohio University Press, 2006. \$55 (cloth).

Inventing Pollution is an ambitious book that aspires to chart the history of "coal, smoke, and culture in Britain since 1800." On the whole, Peter Thorsheim does an admirable job by engaging with existing scholarship on the history of public health, poverty and the poor, degeneration, and urban environments. He integrates this scholarship with archival research from the South, Midlands, and North of England and demonstrates an excellent command of a respectable and varied range of primary published sources. Thorsheim has a talent for distilling ideas and concepts in accessible prose, and he has a good eye for the slightly quirky, which enlivens his narrative with interesting anecdotal tangents: Gladstone on environmental steward-

ship, melanism in Lepidoptera, and the ironically named "Oxygen Street."

Pesticides and pollution occupied a central place in the post-1960s rise of modern environmentalism. Thorsheim provides a self-defined cultural history of the most visible manifestation of air pollution in the century and a half prior to this. One of the great merits of this book is its recognition of the multifarious strands of reform and cultural criticism that lay behind emergent environmentalist concerns and associations. Thorsheim charts the changing meanings of smoke and pollution in the context of urban reform (e.g., public health and crime), heritage preservation, and nature conservation. In broad reductionist terms, he is thereby able to address rural and urban environmental history. Moreover, he contends that the changing definition of pollution demonstrated the malleability of the nature/culture dichotomy. After about 1870, the traditional belief that civilization cleaned and tamed a dirty and unruly nature was displaced by the belief that inherently good and pure nature was tainted by the technological processes of civilization.

Clearly, Thorsheim considers the late nineteenth century a significant turning point in the history of coal smoke pollution in Britain. The majority of the book gravitates toward this period, with most chapters assuming thematic approaches to the subject rather than following a clear chronological history. Consequently, at least 75 percent of the book is an examination of late nineteenth-century history, with occasional glances into twentieth-century developments. Extended examination of the twentieth century is restricted largely to World War II and to the London smog disaster of 1952 and the resultant Clean Air Act of 1956.

John Ruskin's "The Storm Cloud of the Nineteenth Century" (1884) is widely acknowledged as a significant work of cultural criticism. Thorsheim suggests that we should appreciate its title as more than metaphor: increasing coal combustion and the eruption of Krakatoa in 1883 had resulted in a deterioration of air quality in Britain. Thorsheim's explanation is indicative of his approach to environmental history. Commendably, he strives to unite the tangible reality of coal smoke with cultural representations of the phenomenon through time. The book coalesces around this methodological commitment rather than an overarching analytical point. Consequently, it examines an array of cultural perspectives on coal smoke: from beneficial combatant of miasma to harmful purveyor of economic decline, social disorder, and environmental degra-